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Theater Missile Defense: Building Synergy For The Operational Commander.

By

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The contents of this paper reflect my own personal views and are not necessarily  
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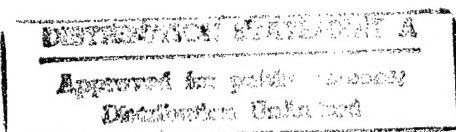
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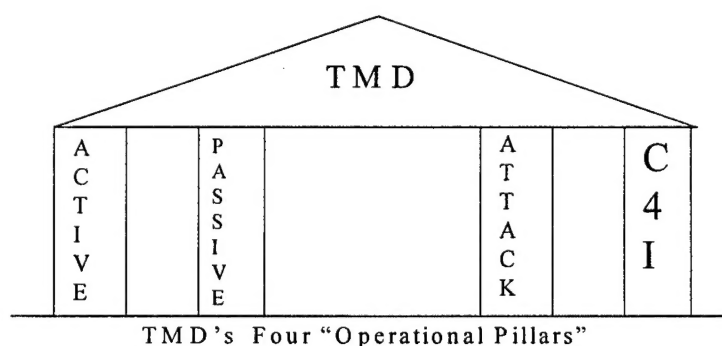
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## Introduction

Synergy occurs between services when their interaction creates a total effect which is greater than the sum of the individual effects. According to Joint Publication 3-01, Doctrine for Joint Operations, "...the synergy of the Joint Force depends in large part on a shared understanding of the operational situation." Nowhere is this facet of operational art more pronounced than with Theater Missile Defense (TMD). Identified as our "Achilles Heel" during the Gulf War, the entire defense arena scrambles to address this strategic and operational vulnerability. Joint Publication 3-01.5, Doctrine for Joint Theater Missile Defense, identifies four operational pillars which build thorough TMD.



**Figure 1: TMD's four operational pillars: Active Defense, Passive Defense, Attack Operations, Command, Control, Communication, & Intelligence (C4I).**

When designing the TMD plan, the commander must integrate the four pillars instead of addressing them as separate entities. The greatest challenge, however, is jointly integrating these pillars. Each military service provides unique and important capabilities to the commander's overall TMD posture. The Air Force continues to improve its ability to locate and destroy enemy Theater Missile (TM) platforms.

Most impressive are the advancements made using laser technology to destroy TMs during the launch and boost phases.<sup>1</sup> Once fielded, this capability will greatly improve the operational commander's TMD plan. The Air Force, however, is the lone service advancing such TMD technologies and, therefore, I do not address its contributions in this paper. I am restricting my focus to the TMD issues which address the interoperability between the Army and the Navy because it is here where I see two services trying to accomplish similar TMD objectives independent of each other.

Both services are working diligently to create thorough mid-course and terminal phase TMD. The Army is currently the only service with active defense capability (Patriot, PAC-2). Additionally, the Army is the only service with actual TMD experience. The Navy, on the other hand, has the "forward deployed" posture which is absolutely essential when initiating TMD. Additionally, the Navy has existing capabilities which, with some modifications, will greatly contribute to the TMD posture. Combining the services' capabilities will create the synergy which is currently missing from our TMD plans. Where do we bring these capabilities together? I argue we do so with the fourth operational pillar: Command, Control, Communications, Computers, and Intelligence (C4I). The Army Theater Missile Defense Element (ATMDE) and the Navy's Cooperative Engagement Capability (CEC) are the platforms which can tie the services' capabilities together. By doing so, the operational commander creates a synergistic TMD that cannot, otherwise, be achieved. To support my thesis I will present the following information. First, I will outline the current TM threat and how we doctrinally plan to defend against it.

Second, I will outline the capabilities of ATMDE and CEC and discuss the benefits of integrating them. Finally, I will address other operational factors that must be synchronized to create a fundamentally joint TMD posture.

### **The Threat: It's Alive and Growing.**

The expansion of theater missiles (TM) over the past decade is phenomenal. (See Appendix A) There are currently over a dozen families of TMs in developing nations. Not only are more countries sporting theater missiles, these missiles are becoming increasingly more lethal and accurate.

Developing nations with theater missiles are a formidable threat. When you look at their relatively low cost, ease of procurement, and ability to carry nuclear, chemical, or biological warheads, one can see how TMs give developing countries strong political and military leverage. While the number of countries capable of creating a nuclear TM is scary, the number of countries capable of developing a chemical/biological capability is much more alarming. Known as the "poor man's atomic bomb", sixteen developing nations currently have a chemical warhead capability.<sup>2</sup>

Today, the US's ballistic missile threat is limited mainly to the battlefield as only Russia and China have the ability to strike our country. Looking into the future, however, we probably won't be able to say that. Speaking after the 1986 American raid on Tripoli, Mu'ammar al'Qaddafi said, "If we had possessed a deterrent -- missiles that could reach New York -- we would have hit it at the same moment. Consequently, we should build this force so that they and others will no longer think about an attack...."<sup>3</sup>

While the threat to the homeland may be some years away, the threat to battlefield is a reality today. The Gulf War, while overwhelmingly successful, exposed some potentially exploitable American vulnerabilities. First, during the early phases of an operation, the potential use of enemy theater missiles against a population center may prevent the U.S. from establishing sufficient political and public support to deploy forces. Additionally, if deployment is authorized, ballistic missile use against critical ports of debarkation could prevent U.S. forces from arriving in theater and cause early and large casualties. This same targeting could also prevent the operational commander from marshaling enough troops, equipment and logistics to initiate and sustain combat operations. Finally, during combat, ballistic missiles used on the battlefield could severely restrict the commander's freedom of maneuver and, therefore, deny him the opportunity to mass forces at the decisive point at the decisive time.<sup>4</sup>

### **Theater Missile Defense: What is It?**

Given the current theater missile threat, the United States has embarked upon a theater missile defense (TMD) program. The mission of TMD is to "...protect U.S. forces, allies, and other countries, including areas of vital interest to the U.S. from theater missile attacks."<sup>5</sup> Current TMD development has evolved from four operational elements: Active Defense, Passive Defense, Attack Operations, and Command, Control, Communication, Computers, and Intelligence (C4I).

**Active Defense:** Active Defenses "...are operations taken to protect against TM attack by destroying TM airborne launch platforms and/or destroying TMs in flight."<sup>6</sup> Active Defense comprises a multitier defense system.

For the U.S. Army, this multitier system will include the Patriot PAC-3 missile system and the Theater High Altitude Air Defense (THAAD) weapon system. Patriot PAC-3 will greatly enhance the system's TMD lower tier capability. Among the improvements over the current PAC-2 missile system are the introduction of the ERINT kinetic energy, hit to kill missile and an enhanced radar capability. PAC-3 fielding is scheduled for 1999.<sup>7</sup> THAAD is the Army's upper tier TMD weapon system. Air liftable by C-141, THAAD will give the operational commander the ability to intercept theater missiles inside and outside the atmosphere. Additionally, because of THAAD's extended range, multiple opportunities to intercept incoming missiles will finally be possible. A prototype THAAD system will be available late in 1998 with full fielding expected sometime in 2006.<sup>8</sup>

In conjunction with its shift from blue water warfare to littoral warfare, the Navy received authorization to advance its Area Defense Ballistic Missile Defense Program, and the Theater-Wide Ballistic Missile Defense Program (NTWD). Utilizing the AEGIS SPY-1 Radar system and an upgraded standard missile Block IV, military forces can take advantage of the Navy's "forward deployed" posture. Like the Army's Patriot PAC-3, the Navy Area Defense Ballistic Missile Defense Program will provide lower tier protection for military forces and critical assets. Current fielding, however, is not scheduled until 2002.<sup>9</sup> NTWD, like THAAD, will provide upper tier ballistic missile protection. Also utilizing the Aegis SPY-1 radar and vertical launch system, NTWD will provide both endo-atmospheric and exo-atmospheric intercept capabilities.



Exactly what interceptor technology NTWD will use is expected to be announced in FY1998 with system deployment still not projected<sup>10</sup>

The four programs mentioned above are receiving a lot of attention and a lot of money. In time, the United States' Active Defense pillar will be strong. As one looks into the immediate future, however, the only thing we currently have to provide active defense is a limited number of Patriot PAC-2 missiles.

**Passive Defense:** Passive Defenses "...are measures taken to posture the force to reduce vulnerability and minimize the effects of a theater missile attack."<sup>11</sup>

Current measures are being worked with existing resources and great advances have been made simply by making passive defenses essential "training" requirements. Effective NBC equipment and proficient NBC training are cornerstones to building strong passive defenses. Operations Security (OPSEC), Communications Security (COMMSEC), camouflage training, site hardening training, and TM early warning drills all assist in strengthening this TMD pillar. The key to improving passive defense is the operational commander's ability to provide timely and accurate early warning to the lowest levels. Doing so will directly enhance battlespace survivability. As you will read later, the systems capable of providing the commander this information are available.

**Attack Operations:** Attack Operations are "...operations taken to destroy, disrupt, or neutralize TM launch platforms and their supporting structures and systems."<sup>12</sup> Services are working jointly to put "steel on target" quicker and more accurately once TM delivery vehicles are identified.

Recent exercises have utilized the firepower capabilities of the Army's AH-64 Apache Helicopter and the Attack Missile System (ATACMS) surface to surface missile to perform attack operations on known enemy TM sites.<sup>13</sup> Add to this the progress made by the Joint Forces Air Component Commander (JFACC) and the Joint Forces Special Operations Component Commander (JFSOCC) in locating and destroying TM platforms, and one can see that progress is being made to strengthen this pillar.

**Command, Control, Communication, Intelligence (C4I):** C4I systems are used "...to coordinate and integrate the joint force capabilities to conduct and link passive defense, active defense, and attack operations."<sup>14</sup> The advancements made in the other three pillars improve the US's TMD capability. The key to accelerating this improvement, I argue, is C4I, for it is through C4I that we move from a stovepipe approach, where operations are not well integrated and therefore, troops are at risk, to an integrated approach, which capitalizes on the synergy created when we synchronize all four pillars. The Army and the Navy are working very hard to advance their individual C4I capabilities. By integrating each service's C4I, the operational commander has the capability to exponentially synergize his force's TMD capability.

### **The Army Theater Missile Defense Element (ATMDE)**

**What is ATMDE?** "ATMDE is a U.S. Army Space Command initiative to provide the Land Component Commander (LCC) a planning and coordination capability to analyze his situation, establish his TMD priorities, and assist in defense design to meet mission requirements."<sup>15</sup>

By connecting the four operational TMD pillars, it acts as "...the fusion and synchronization operations center designed to provide the LCC [Operational Commander] with the ability to integrate air, ground, and sea battle information in support of TMD, and direct and control attack operations and active defense elements conducting TMD operations."<sup>16</sup> Simply put, ATMDE gives the operational commander the ability to integrate the four TMD operational pillars so he can capitalize on their synergistic effect. ATMDE consists of five high-mobility, multipurpose wheeled vehicles (HMMWV's) known as the Force Projection Tactical Operations Center (FP-TOC), and 35 soldiers who specialize in operations, intelligence, fire support, air defense, and nuclear-biological-chemical warfare.<sup>17</sup> C141 transportable, ATMDE is rapidly deployable. Put to the test during Exercise Roving Sands 95', ATMDE proved to be a formidable combat multiplier. It will soon be provided to the Third United States Army as an operational capability.<sup>18</sup>

**What can ATMDE do?** ATMDE provides the operational commander with the ability to directly receive TM information via the Joint Tactical Ground System (JTAGS). Once received, the commander can pass the information to subordinate units using two separate means. First, he can send the early warning using the traditional cascade approach. This approach utilizes existing chain of command relationships and conventional voice radio communications to disseminate the information. While capitalizing on the chain of command's inherent "filtering" process, (i.e. a commander decides whether the report needs to be passed to a subordinate unit) it remains a very time consuming process. The second mode utilizes cellular technology.

ATMDE transmits TM early warning information in seconds simply by passing the information to cellular beepers. This digital approach is much quicker but only provides limited message content capability.<sup>19</sup> Either way, the commander's ability to receive JTAGS information directly from the satellite improves the force's passive defense operations because TM early warning can arrive at the troop level up to a minute faster than before.<sup>20</sup> With TM flight times as short as five minutes, every minute of post-launch early warning is critical.

ATMDE provides the operational commander the ability to coordinate attack operations by directly linking the commander to the Army Tactical Missile System (ATACMS), a surface to surface missile system with approximately a 100 kilometer range, and the U.S. Army's AH-64 Attack Helicopter. Test results demonstrated ATACMS ability to put "steel on target" within minutes whereas coordination with the Apache units took longer.<sup>21</sup> While some bumps still exist in performing these attack operations, primarily reaction time and deep strike limitations, this capability does expand the commander's ability to destroy TM platforms.

ATMDE provides the operational commander a platform to receive intelligence from a host of sources. The All Source Analysis System (ASAS), a target location and identification sensor, allows the commander to quickly pass attack operations information to the attack operations force.<sup>22</sup> The Predator Unmanned Aerial Vehicle provides, among other things, reconnaissance, surveillance, target acquisition, and Battle Damage Assessments (BDA).<sup>23</sup>

These are just a two of several intelligence platforms available to the commander. Combined, they give him a much better battlespace picture and inherently allow him to make well informed decisions.

**How the ATMDE should be used.** The operational commander can best use ATMDE as the primary C2 node during initial entry operations into a theater. Since TMD must be established before the forces and equipment arrive, ATMDE offers several capabilities. First, it can incorporate all active defense capabilities into a single picture. This gives the commander a 'real time' assessment of his active TMD capabilities. Second, it provides a central communications net to send early warning TMD messages. This capability strengthens the force's passive defense capabilities. Finally, ATMDE provides an adequate C2 node to conduct attack operations. Given its many intelligence platforms and ability to communicate directly with attack operation platforms, ATMDE can centrally process the entire attack operation from identification, to mission execution, to BDA.

Because it has a finite ability to integrate all aspects of a major regional conflict, ATMDE is best suited for initial entry operations. As a theater matures and an ever increasing number of military nodes need to integrate, ATMDE will not be capable of providing C2 functions. It can, however, be transformed into a coordination and information dissemination cell still capable of coordinating attack operations and performing TM early warning.<sup>24</sup>

Best of all, ATMDE can deploy today. Unlike our futuristic answers to active defense, ATMDE is a force multiplier today.

Having experienced two rotations through Exercise Roving Sands and many other joint military exercises, it is simply ironing out the wrinkles that come with most new systems. It is, for example, working with the Air Force's combat information system to ensure interoperability exists with the Air Force Electronic Systems Command.<sup>25</sup> ATMDE is the Army's single greatest TMD initiative since the Gulf War. Capable of operating at both the tactical and operational level, any Joint TMD program must utilize the ATMDE's capabilities.

### **The Navy's Cooperative Engagement Capability (CEC)**

**What is CEC?** Recognizing the need for an air defense central processing point, the Navy set out to find a system that could receive battlespace information from many sources, consolidate this information into coherent intelligence and then pump that intelligence out to the battlespace for all commanders to use. Subscribing to the idea that the "whole is greater than the sum of the parts", the Navy is developing CEC. The Cooperative Engagement Capability, when fielded, will take advantage of the diversities provided by each participating user so everyone in the system can benefit from what was, at one time, available only to the original source. For the first time, and very similar to ATMDE, units networked into the CEC can operate as a "...single, distributed, theater defensive system."<sup>26</sup>

**What can CEC do?** CEC can perform three separate, but interdependent, functions. It can provide composite tracking, precision cueing, and coordinated, cooperative engagements.

Composite Tracking: CEC's primary capability provides each subscriber composite tracking. Composite tracking is the process of collecting independently produced radar data, transforming all the data into a single, easy to understand, air picture, and then returning the consolidated results back to the individual users. Thus, even if an individual user's radar fails, he remains active because he still receives the picture provided by the other CEC users. Given the increasingly important need to "see" the rapidly changing battlespace, composite tracking ensures an almost uninterrupted picture for everyone.<sup>27</sup>

Precision Cueing: Precision cueing allows a combat system to prepare for an engagement even before the system's radar acquires the hostile target. Capitalizing on the "big picture" created by all CEC users, a combat system can cue to a specific direction in anticipation of the system's radar detecting the hostile target. This precision cueing increases the combat system's engagement preparation time and can greatly reduce the "false alarm" rate associated with large radar sweeps. Studies and tests have also shown that individual system's acquisition range can be greatly extended because precision cueing allows the radar to focus on a specific, rather than general, area.<sup>28</sup>

Coordinated, Cooperative Engagements: A true combat multiplier, coordinated, cooperative engagement allows a combat system to fire a missile, guide it to the target and destroy the target, using radar data from another CEC element. This "remote engagement" capability is transparent to the combat system's operator.<sup>29</sup> Imagine the stealth advantages this capability offers.

Using the radar picture provided by sources well to the rear, combat systems can enter enemy territory with transmitting radars silent, locate, engage, and destroy hostile targets, and safely return to their base stations. The coordinated, cooperative engagement keeps an otherwise non-operational system in the battle, (i.e. by using another radar to guide the missiles from a deadlined radar unit) and it increases these systems' lethality and survivability.

**How CEC should be used.** From the perspective of combating theater missiles, CEC offers some distinct and valuable capabilities. First, consolidating the information received by radars positioned throughout the battlespace, CEC can provide uninterrupted early warning of inbound theater missiles. Because the CEC's picture is a composite of air, land, and sea radars, even rough terrain won't inhibit the CEC's ability to continuously track the incoming missiles. Early in the TM's flight, the CEC can predict the probable impact site, provide the affected areas early warning for passive defense measures and prevent unaffected sites from taking unnecessary passive defense measures.

From an active defense perspective, CEC offers two advantages. First, it can assist in preventing multiple engagements by various combat systems by directing the TM engagement. In an area where sufficient missiles don't exist, CEC can ensure we engage incoming missiles with sufficient, but not excessive, force. Additionally, the coordinated, cooperative engagement function keeps the limited missile resources in the battle even if the missiles' radar is non-operational. Future TM attacks will likely take on a "saturation" affect where multiple TM will be launched near simultaneously.

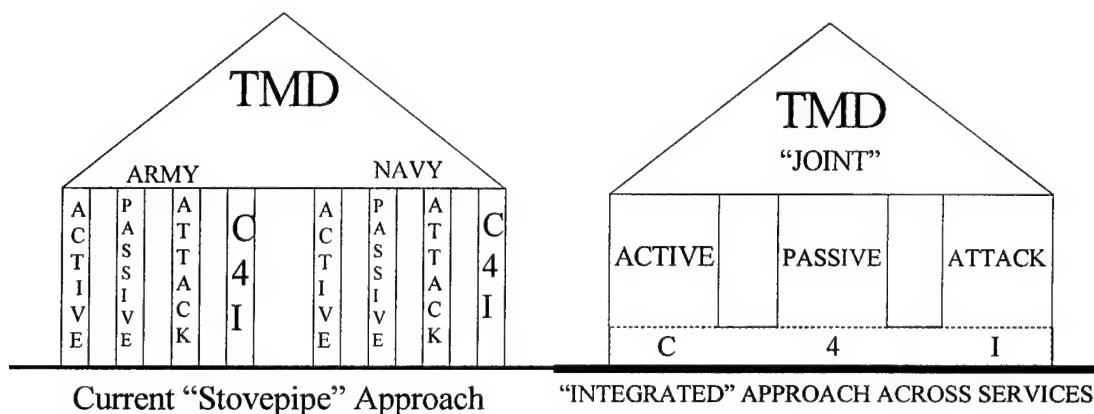


Given this potential enemy use of TMs, we must be able to access, coordinate and launch many anti theater missiles in a short period of time. CEC provides this capability.

Last, but certainly not least, the Aegis housed CEC offers the operational commander a forward deployed TMD C4I capability. Especially noteworthy is CEC's ability to operate without putting troops on the ground. This becomes especially important if the U.S. cannot gain host nation approval to put troops on the ground or if the situation requires "forced entry" into the area of operation. Either way, CEC offers the commander critical C4I early and throughout an operation.

## The Synergy

Imagine the "big picture" created when the operational commander fuses ATMDE's capabilities with CEC. Every combat system designated to defend against theater missiles can work in sync. Marrying up the operational pillars of both services, the commander creates a much greater TMD capability than currently exists.



**Figure 2: (Left) Depicts current Army and Navy TMD approach. Figure 3: (Right) Depicts a joint, integrated approach to TMD with ATMDE and CEC combining to make the C4I foundation.**

Not only can the combat systems work together, but they also create an inherent redundancy in performing TMD operations. TMD has advanced to the point where we need to shift our efforts from a bottom-up approach (which focuses on the quick fix) to a top-down approach where we coordinate, consolidate, and integrate all TMD capabilities. ATMDE and CEC are the platforms, that when properly connected, provide this capability. Of course, on paper, this seems easy. There are several Command and Control (C2), doctrinal, and communication issues which must be addressed before this suggestion can become a reality. First, who retains overall C2 when the systems integrate? Along the same lines, is a C2 relationship necessary or could the operational pillars best be served by just "sharing" the information? I'll reserve the answers to these questions for a future paper. Additionally, implied in a marriage this size is the need for a liaison officer exchange program. While both services are in the same basic business, "fighting our nation's wars", our doctrines are sufficiently different that we do so quite differently. Technology will allow the systems to talk, but it still requires human understanding to make the systems do what we want them to do. A well trained liaison officer provides this "human understanding". Finally, the Joint Theater Missile Defense (JTMD) arena must publish a common set of information indicators; among them, message format, vocabulary, symbology, and reference points. Standardizing these communication formats will aid in information interpretation and assist in making smoother operations.

## **Conclusion**

Theater missiles are a real threat to future military operations. Great effort and progress is being made to improve our active defense capabilities. Likewise, passive defense and attack operations are improving. In the dawn of the "Information Age", we must capitalize on our technological advantage and make C4I the cornerstone of our overall TMD program. As individual services, the U.S. Army and U.S. Navy have combat multiplying systems in the inventory. ATMDE and CEC are the keys to converting our TMD doctrine from a "stovepipe" approach to an "integrated" approach. Our real goal should be to expand the "integrated" approach to the joint military arena for it is only when we integrate across the services that we will harness the synergy created by a Joint Theater Missile Defense.

## Endnotes

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<sup>1</sup> Swicker, Charles C., "Theater Ballistic Missile Defense From The Sea: Issues For The Maritime Component Commander," Unpublished Research Paper, U.S. Naval War College, Newport, RI: 1995, 118.

<sup>2</sup> Ballistic Missile Defense Organization, Fact Sheet 96-009: Ballistic Missiles and the World Security Environment, (February 1996), 1.

<sup>3</sup> Ibid.: 2.

<sup>4</sup> Garner, Jay M., "Working at Top Speed to Bolster Theater Missile Defense," Army, October 1995, 152.

<sup>5</sup> Ballistic Missile Defense Organization, Fact Sheet 96-001: U.S. Ballistic Missile Defense Program Focus, (March 1996), 1.

<sup>6</sup> "Doctrine for Joint Theater Missile Defense". Joint Pub 3-01.5 22 February 1996, viii.

<sup>7</sup> Ballistic Missile Defense Organization, Fact Sheet 95-002: Patriot Advanced Capability-3, (August 1996), 2.

<sup>8</sup> Ballistic Missile Defense Organization, Fact Sheet 95-004: Theater High Altitude Air Defense System (THAAD), (August, 1996) 2.

<sup>9</sup> Ballistic Missile Defense Organization, Fact Sheet 95-003: Navy Area Defense Ballistic Missile Defense Program, (August 1996) 2.

<sup>10</sup> Ballistic Missile Defense Organization, Fact Sheet 95-001: Navy Theater Wide Ballistic Missile Defense Program, (August 1996) 2.

<sup>11</sup> JP3-01.5, viii.

<sup>12</sup> Ibid.: 2.

<sup>13</sup> United States Army Operational Test and Evaluation Command, Theater Missile Defense 95: Advanced Warfighting Experiment Assessment (TMD95AWEA) (Draft), (Fort Bliss, Texas: 1995), 2-12 through 2-14.

<sup>14</sup> JP3-01.5, viii.

<sup>15</sup> United States Army Air Defense Artillery School, Report on the Theater Missile Defense Advanced Warfighting Experiment (TMDAWE) (Draft), (Fort Bliss, Texas: 1995), 34.

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<sup>16</sup> Ibid.: 34-35.

<sup>17</sup> Garner, October 1995, 154.

<sup>18</sup> TMDAWE, 35.

<sup>19</sup> Ibid.: 16

<sup>20</sup> Garner, Jay M., "Army Theater Missile Defense", Army, December 1995, 19.

<sup>21</sup> TMDAWE, 26-27.

<sup>22</sup> Ibid.: 34.

<sup>23</sup> Ibid.: 41.

<sup>24</sup> TMD95AWEA, 2-17.

<sup>25</sup> Garner, October 1995, 154.

<sup>26</sup> Johns Hopkins APL Technical Report, The Cooperative Engagement Capability, 16 (4), October-December 1995, 378.

<sup>27</sup> Ibid.: 379.

<sup>28</sup> Ibid.: 379.

<sup>29</sup> Ibid.: 379.

APPENDIX A

THE THREAT

# THE THREAT

## Ballistic Missiles in Developing Countries

### Range Category (km)

| Country    | Range Category (km) |                                  |                      |                       |                   | Supplier   |
|------------|---------------------|----------------------------------|----------------------|-----------------------|-------------------|--|
|            | 30-250              | 300                              | 500-650              | 800-1,200             | 1500              |  |
| Afganistan |                     | ScudB                            |                      |                       |                   | USSR   |
| Brazil     | MB/EE-150           | MB/EE-300                        | MB/EE-600            | MB/EE-1000            |                   | Indigenous   |
|            | SS-150              | SS-300                           |                      | SS-1000               |                   | Indigenous   |
| China      | B-610               | M-11                             | M-9                  |                       | CSS-2 and<br>DF21 | Indigenous   |
| Egypt      |                     | Scud B<br>Scud B                 | Scud C               |                       |                   | USSR<br>North Korea<br>"License"<br>Indigenous     |
| India      | Pritivi             |                                  |                      |                       | Agni              | Indigenous   |
| Iran       |                     | Scud B<br>Scud B<br><br>Iran-130 | Scud C               |                       |                   | USSR<br>North Korea<br><br>"License"<br>Indigenous |
| Iraq       |                     | Scud B<br>Scud B                 | Scud C<br>Al Hussein | Al Abbas<br>Badr 2000 | Al Abed           | USSR<br>North Korea<br>Indigenous<br>Indigenous    |
| Libya      | SS-21               | Scud B                           | Scud C<br>M-9        | Al Fatah              | Scud C<br>M-9     | USSR<br>North Korea<br>China<br>Indigenous         |

# THE THREAT

## Ballistic Missiles in Developing Countries

### Range Category (km)

| Country      | Range Category (km) |                  |               |           |                                  | Supplier                     |
|--------------|---------------------|------------------|---------------|-----------|----------------------------------|------------------------------|
|              | 30-250              | 300              | 500-650       | 900-1,200 | 1500                             |                              |
| North Korea  |                     | Scud B           | Scud C        | No Dong 1 | No Dong 2<br>Taepo Dong<br>1 & 2 | Indigenous                   |
| Pakistan     | Haft 1              | M-11<br>Haft 2   |               |           |                                  | China<br>Indigenous          |
| Saudi Arabia |                     |                  |               |           | CSS-2                            | China                        |
| South Africa |                     |                  | Arniston      |           |                                  | Indigenous                   |
| South Korea  | NHK-1, -2<br>Lance  | NHK-A            |               |           |                                  | Indigenous<br>United States  |
| Syria        | SS-21               | Scud B<br>Scud B | Scud C<br>M-9 |           |                                  | USSR<br>North Korea<br>China |
| Taiwan       | Green Bee           |                  |               | Sky Horse |                                  | Indigenous                   |
| Vietnam      |                     | Scud B           |               |           |                                  | USSR                         |
| Yemen        | SS-21               | Scud B           |               |           |                                  | USSR                         |

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